

SYSTEM FOR DISPOSING A PROXIMITY SENSITIVE TOUCHPAD BEHIND A MOBILE PHONE KEYPAD

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This document claims priority to, and incorporates by reference all of the subject matter included in the provisional patent application having serial No. 60/296,414 and filed on Jun. 06, 2001. This document also claims priority to, and incorporates by references all of the subject matter included in four co-pending applications having Ser. No. 09/603,417 and filed on Jun. 22, 2000, having Ser. No. 09/759,609 and filed on Jan. 11, 2001, and having Ser. No. 09/656,522 and filed on Sep. 07, 2000.

BACKGROUND

[0002] 1. The Field of the Invention

[0003] This invention relates generally to touchpads and mobile telephones. Specifically, the invention relates to adapting a touchpad so that it can be disposed and operated while underneath a keypad of a mobile telephone, wherein the user operates the keypad by pressing keys on a keymat in a typical manner, and wherein the touchpad disposed underneath the keymat can be activated to thereby enable manipulation of a display in the mobile telephone so as to control a cursor, scroll bars, and alphanumeric data entry in the mobile telephone.

[0004] 2. Background of the Invention

[0005] Portable information appliances include portable communication devices known by many popular names such as cellular telephones, cell phones, and mobile telephones (hereinafter referred to collectively as "mobile telephones") to name a few. Mobile telephones are now capable of providing more services than just voice transmission. For example, mobile telephones now provide data services such as access to the Internet for web browsing and for using email. These services are becoming ubiquitous as the infrastructure to provide them is becoming more widely available.

[0006] There are several problems that inhibit use of these data services. Because these mobile telephones are small devices, there is a lack of surface space on them in which to implement data entry and display control technologies. A mobile telephone must typically rely on the keypad as the main source of alphanumeric data input and display control. Unfortunately, experience has shown that using the keypad for all types of data entry and display control is inefficient, slow, cumbersome, and frustrating to the user. Thus, while the ability to easily navigate a graphical interface such as a mobile telephone web browser and to rapidly enter text in a word processor in order to send email is highly desirable, it is unfulfilled.

[0007] It would therefore be an advantage over the prior art to provide a system that enables both rapid data entry and graphical display control in a portable information appliance, such as the mobile telephone. Ideally, the system should enable the mobile telephone to retain its conventional keypad, while providing a touchpad and the associated touchpad capabilities. However, the system should not require a separate touchpad surface. Thus, the system should

incorporate a touchpad without modifying the appearance of the mobile phone. The touchpad could be disposed underneath the keymat and be actuated by a switch or other means of activation.

[0008] Alternatively, the touchpad could be disposed underneath a display screen, or underneath some portion of the body of the mobile telephone where a user can run a finger over a surface thereof. What is important is that the touchpad operate through proximity sensing, and thus not require direct contact with the touchpad in order to operate. The surface through which the touchpad could detect a pointing object could be the keymat of the keypad, an LCD display screen, or a portion of the body of the portable information appliance that is easily accessible by touch.

SUMMARY OF THE INVENTION

[0009] It is an object of the present invention to provide a proximity sensitive touchpad that is capable of providing touchpad functionality while disposed underneath a keymat of a keypad.

[0010] It is another object of the invention to provide the proximity sensitive touchpad such that a post for each key on the keymat passes through a mutually capacitive sensor electrode grid of the touchpad.

[0011] It is another object of the invention to modify spacing of the electrodes on the mutually capacitive sensor to enable the posts to pass through the electrode grid.

[0012] It is another object of the invention to bend or angle some of the electrodes around apertures disposed through the touchpad in order to enable mechanical switches to be actuated.

[0013] It is another object of the invention to modify sensor algorithms to compensate for the modified spacing and the bends or angles made in electrodes on the touchpad.

[0014] It is another object of the invention to provide a separate touchpad that provides dedicated functionality as a scrolling mechanism.

[0015] It is another object of the invention to provide the separate touchpad such that it is disposed to be accessible when the mobile telephone is closed, when the mobile telephone has a cover that can be closed.

[0016] In a preferred embodiment, the present invention is a proximity-based mutually capacitance-sensitive touchpad that is disposed directly beneath a keypad keymat of a mobile telephone, wherein posts associated with each key pass through a mutually capacitance-sensitive sensor electrode grid of the touchpad such that the keypad posts do not interfere with touchpad detection and tracking of a pointing object that moves along the keypad surface, to thereby enable touchpad data entry, cursor control, and scroll bar control on a display of the mobile telephone, wherein the keypad posts actuate mechanical switches underneath the touchpad.

[0017] In a first aspect of the invention, the electrode grid for the proximity-based mutually capacitance-sensitive touchpad is disposed on a flexible and non-conductive substrate material.

[0018] In a second aspect of the invention, holes are disposed through the substrate material to enable movement of the keypad posts up and down therethrough.